Residential Refrigeration Program

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ARB Workshop on Stationary High-GWP Early Action Items

February 15, 2008

Outline

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- Data Source, Emissions and Trends
- Existing Regulations
- Potential Control Strategies & Costs/Benefits
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Background

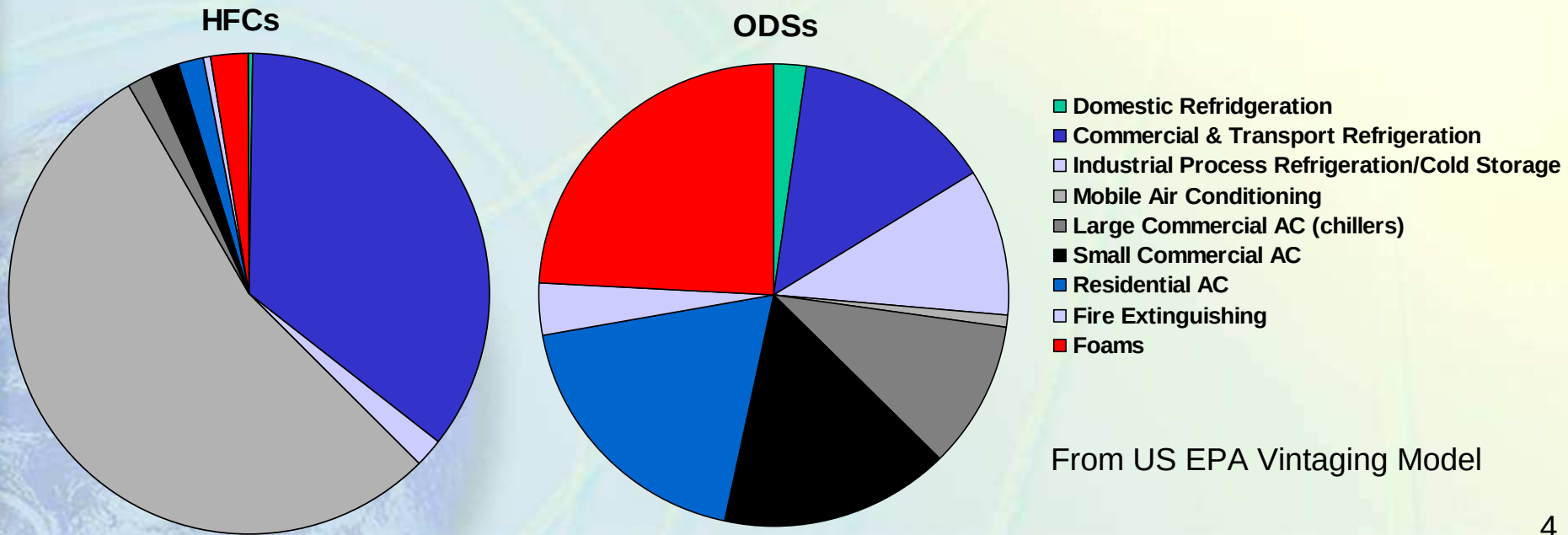
- **Over 1 million Domestic Refrigerators, Freezers, and Air Conditioners (A/Cs) are Disposed of in California Each Year**
  - Some discarded appliances are working, some are non-working
- **Derived from National Estimates (US EPA, 2006)**

	Weight per unit	Pre 1996	Pre 2002	Post 2002
Refrigerant	~ 0.5 lb	CFC-12 GWP 10,600 CO2E	HFC-134a GWP 1,300 CO2E	HFC-134a GWP 1,300 CO2E
Blowing agent	~1.0 lb	CFC-11 GWP 4,600 CO2E	HCFC-141b GWP 700 CO2E	HFC-245fa GWP 950 CO2E

Data Source, Emissions and Trends

- **Estimated CA Residential Refrigerator Direct Emissions**
  - HFC emissions ~ 0.02 MMTCO2E
  - ODS emissions ~ 0.7 MMTCO2E
    - Annual growth rate estimated at 0.5% per year

2006 CA Emission Sources

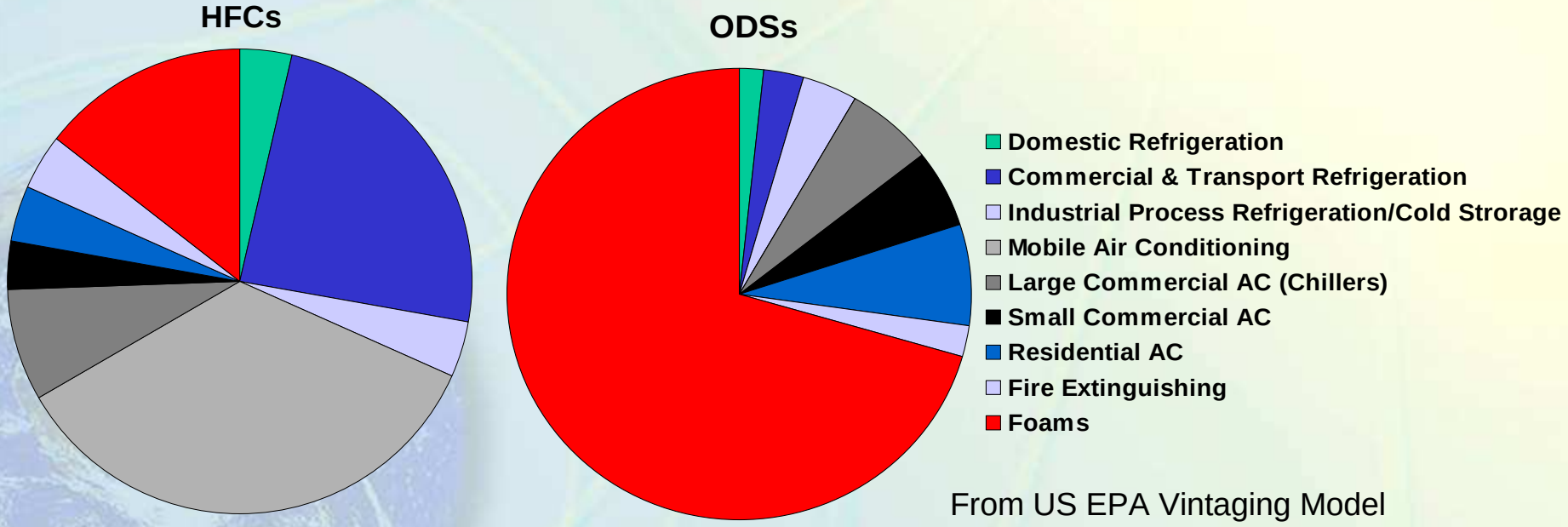


From US EPA Vintaging Model

Existing Equipment "Banks"

- **Estimated Banks in CA Residential Refrigerators**
  - ODS Banks ~12 MMTCO2E
  - HFC Banks ~3 MMTCO2E
    - Annual growth rate estimated at 0.5% per year

2006 CA Banks



From US EPA Vintaging Model

Existing Regulations

- **Federal Regulations**
  - Section 608(b) of the CAA requires that ODS contained in bulk in appliances be removed prior to recycling or disposal (40 CFR Part 82 Subpart F)
  - Section 608 also requires the recovery of all **refrigerants** for destruction or reclamation (40 CFR Part 82 Subpart F)
  - Subtitle C of the Resource Conservation & Recovery Act (RCRA) and Subpart D of the Toxic Substances Control Act (TSCA) require proper management and storage of universal waste e.g. **mercury**, **used oil**, and **PCBs** (40 CFR Parts 273, 279, 761)

US EPA Responsible Appliance Disposal partnership

- **13 Utilities + One Retailer to Date**
- **Commit to Best Practices**
  - Refrigerant is recovered and reclaimed or destroyed
  - Foam is recovered and destroyed, or the blowing agent is recovered and reclaimed
  - Metals, plastic, and glass are recycled
  - PCBs, mercury, and used oil are recovered and properly disposed
- **Removes Old, Inefficient Refrigerators, Freezers, Air Conditioners, and Humidifiers From the Grid**

Best Practice Appliance Recycling

- **Using Best Practices defined in the RAD Program Approximately 95% of the Refrigerator is Recycled**

- **At Least Three Facilities in California**
  - Currently service utility programs including EPA's RAD Program partners
    - Utilities only take *working* appliances off the grid and use the savings to fund best practice appliance recycling (as performed by facilities like JACO/ARCA)
  - Capacity to cover entire state

Benefits of Responsible Appliance Disposal

For every 1.5 million inefficient refrigerators replaced with an Energy Star refrigerator, greenhouse gas emissions are reduced by 1 MMTCO2E. This is equivalent to:

- **179,000 passenger cars NOT driven for one year**

International Programs

Japan	Domestic appliances	All F-gases must be recovered and re-used/destroyed at equipment EOL, including blowing agents
EU	All R/AC equipment	CFC/HCFC refrigerants and blowing agents must be recovered during servicing and EOL, and either destroyed, recycled, or reclaimed
China	Refrigerators and AC units	No mandate for foam recovery. Equipment manufacturers must design for recycling/reuse, select non-hazardous materials, and treat their own waste.
Canada	Any R/AC system	All halocarbon refrigerants must be recovered; no requirement for foam blowing agents. Voluntary return program in Ontario.
Austria	Appliances	In addition to EU programs, retailers take back equipment for local recycling stations.

Potential Control Strategies

- **Support Existing Voluntary, National Programs for Comprehensive Home Appliance Disposal**
  - US EPA Responsible Appliance Disposal partnership
    - » 13 utilities and one retailer to date
  - Increase participation in this program, as well as individual utility programs
  - Complement a regulatory program to recover and destroy high-GWP blowing agents in waste foams

Costs/Benefits

- **Responsible Appliance Recycling Costs/Benefits**
  - Costs
    - Energy Star rating adds between $39 to $85 to the price of a basic refrigerator/freezer.
    - Appliance disposal programs implemented by utility companies, on average, cost $0.04 to reduce each kWh of energy demand.
  - Benefits
    - Replacing an inefficient, 20-year old refrigerator with an ENERGY STAR rated refrigerator will save a household roughly 700 kWh/year or more -or upwards of $50/year.
    - If a secondary refrigerator (e.g., in a basement or garage) is removed and not replaced, households can save about 1,200 kWh/year, or over $100/year.

Data Gaps & Research Needed

- Case studies from EPA RAD program ongoing
- Verification of California-specific estimates
- Indirect emission reductions will be updated based on possible future Energy Star specs and efficiency standards

Working Group Formation

- Address data gaps and identify/evaluate policy options
- Key Stakeholders
  - Appliance manufacturers
  - Landfill operators
  - Appliance and chemical recyclers
  - Utilities
  - Retailers
  - Others?

Timeline

April 2008	Working Group/Stakeholder Formation
Summer 2008	Working Group/Stakeholder Consultation Meeting
Fall 2008	1st Public Workshop to Discuss Control Strategies and Options
Winter 2009	2nd Working Group/Stakeholder Consultation Meeting
Spring 2009	2nd Public Workshop on Proposed Strategies
Fall 2009	Submit Final Report to Board

Contact Information

- **Chuck Seidler (Project Lead)**

  Greenhouse Gas Reduction Strategy Section

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- **More Information**
  - Visit: **http://www.arb.ca.gov/cc/residref/residref.htm**
  - Join list serve at: **http://www.arb.ca.gov/listserv/listserv.php**

Questions?